CITY OF TEMPE AMENDMENTS TO THE 2009 INTERNATIONAL RESIDENTIAL CODE ARTILE II, SECTION 8-300 OF THE TEMPE CITY CODE

Sec. R201 GENERAL

Section R201.4. Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies. Webster's Third New International Dictionary of the English Language, Unabridged, shall be considered as providing ordinarily accepted meanings.

Sec. R202 DEFINITIONS

EMERGENCY ESCAPE AND RESCUE OPENING. An operable window, door or similar device that provides for a means of escape that opens directly into a public street, public alley, yard or court and provides access for rescue in the event of an emergency.

EXTERIOR WALL. Any above-grade wall or element of a wall or any member or group of members, which has a slope of 60 degrees or greater with the horizontal plane that defines the exterior boundaries or courts of a building. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and basement walls with an average below-grade wall area that is less than 50 percent of the total opaque and nonopaque area of that enclosing side.

Sec. R301 DESIGN CRITERIA.

Section R301.1.1. Alternative provisions. As an alternative to the requirements in Section R301.1 with prior approval of the building official the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards the design shall comply with the *International Building Code.*

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual* (WFCM).
2. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing-Prescriptive Method for One- and Two-family Dwellings* (AISI S320).
3. ICC-400 *Standard on Design and Construction of Log Structures.*

Table R301.2 (1) CLIMATIC AND GEOGRAPHICAL DESIGN CRITERIA

Table R301.2 (1)
CLIMATIC AND GEOGRAPHICAL DESIGN CRITERIA

GROUND SNOW LOAD	WIND DESIGN		SEISMIC DESIGN CATEGORY[g]	SUBJECT TO DAMAGE FROM				WINTER DESIGN TEMP[e]	ICE SHIELD UNDER-LAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEAN ANNUAL TEMP.[j]
	Speed[d] (mph)	Exposure		Weathering[a]	Frost line depth[b]	Termite[c]						
0	90 3 sec	C	C	Negligible	12 inches	moderate to heavy		34 degrees	N/A	See Maricopa County	0	71.2°F

Table R301.5 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(In pounds per square foot)

USE	LIVE LOAD
Attics without storage [b]	10
Attics with limited storage [b, g]	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks [e]	40
Fire escapes	40
Guardrails and handrails [d]	200[h]
Guardrails in–fill components [f]	50[h]
Passenger vehicle garages [a]	50[a]
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40[c]

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2,
1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.

b. Attics without storage are those where the maximum clear height between joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide, or greater, located within the plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.

c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.

d. A single concentrated load applied in any direction at any point along the top.

e. See Section R502.2.1 for decks attached to exterior walls.

f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

g. For attics with limited storage and constructed with trusses, this live load need be applied only to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high or greater by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met.

1. The attic area is accessible by a pull-down stairway or framed in accordance with Section R807.1.
2. The truss has a bottom chord pitch less than 2:12.
3. Required insulation depth is less than the bottom cord member depth.

The bottom chords of trusses meeting the above criteria for limited storage shall be designed for the greater of the actual imposed dead load or 10 psf, uniformly distributed over the entire span.

h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

Sec. R302 FIRE-RESISTANT CONSTRUCTION

R302.2 Townhouses. Each townhouse shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **Exception:** A common 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of time indicated by the required fire-resistance rating. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common 2-hour fire-resistance-rated wall as provided in Section R302.2.

Sec. R302 FIRE-RESISTANT CONSTRUCTION

TABLE R302.1
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		**MINIMUM FIRE-RESISTANCE RATING**	**MINIMUM FIRE SEPARATION DISTANCE**
Walls	(Fire-resistance rated)	1 hour-tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet[a]
	(Not fire-resistance rated)	0 hours	≥ 5 feet
Projections	(Fire-resistance rated)	1 hour on the underside	≥ 2 feet to 5 feet[b]
	(Not fire-resistance rated)	0 hours	5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet

Penetrations	All	Comply with Section R317.3	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.

a. Existing dwellings or additions thereto which were legally constructed prior to the effective date of this provision with exterior wall(s) and/or column(s) existing at ≥ three (3') from lot line may continue or extend the use of the existing condition without complying with this provision provided:
   - Any new addition is on the same side of the dwelling where the existing exterior wall line is ≥ three (3') from lot line.
   - The new addition's exterior wall line and the existing dwelling/addition exterior wall line are on the same plane.
   - Projections < three (3') feet from property line are of one (1) hour fire-resistive construction on the underside.
   - Projections maintain a minimum fire separation distance of ≥ two (2') feet from property line.

b. Except where allowed as noted in footnote (a) above.

Sec. R302 FIRE-RESISTANT CONSTRUCTION

Section R302.5.1. Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1⅜ inch (35 mm) in thickness, solid or honeycomb core steel doors not less than 1⅜ inches (35 mm) thick, or 20-minute fire-rated doors. Doors providing opening protection shall be maintained self-closing and self-latching.

Sec. R308 GLAZING

R308.4 Hazardous locations. The following shall be considered specific hazardous locations requiring safety glazing materials:

1. No Change
2. No Change
3. No Change
4. No Change
5. Glazing in doors and enclosures for or walls facing hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing surface or walking surface. All other interior or exterior glazing in bathrooms, shower rooms or other similar areas, the bottom edge of which is less than 60 inches (1524 mm) above the standing or walking surface.
6. No Change
7. No Change
8. No Change

Sec. R311 MEANS OF EGRESS

Section R311.2. Egress door. At least one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a minimum clear width of 32 inches (813 mm) when measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). The minimum clear height of the door opening shall not be less than 78 inches (1981 mm) in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort.

Exception: One and two-family dwellings and individual dwelling units of townhomes not more than three stories above grade plane may be provided with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or special knowledge or

effort.

Sec. R313 AUTOMATIC FIRE SPRINKLERS IS DELETED.

Sec. R314 SMOKE ALARMS

R314.4 Power source. Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be interconnected either by hard-wiring or with listed wireless alarms.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power or where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure.

2. Hard-wiring of smoke alarms in existing areas shall not be required where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for hard wiring without the removal of interior finishes.

Sec. R315 CARBON MONOXIDE ALARMS

R315.4 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Carbon monoxide alarms shall be interconnected either by hard-wiring or with listed wireless alarms.

Exceptions:

1. Carbon monoxide alarms shall be permitted to be battery operated when installed in buildings without commercial power or where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure.

2. Hard-wiring of carbon monoxide alarms in existing areas shall not be required where the alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for hard wiring without the removal of interior finishes.

Sec. R319 SITE ADDRESS

Section R319.1 Address numbers. Buildings shall have approved address numbers, building numbers or approved building identification placed in a position that is plainly legible and visible from the street or road fronting the property. The actual size, color, and field placement of addresses numbers shall be as specified in the Tempe Zoning and Development Code.

Exceptions: Buildings constructed prior to January 20, 2005 may replace missing address numbers with numbers that are a minimum 4 inches (102mm) high with a minimum stroke width of ½ inch (12.7mm) that have a color contrast with the background color of at least fifty (50%) percent.

Sec. R322 FLOOD-RESISTANT CONSTRUCTION

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V

Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with the Tempe City Code, Chapter 12 and applicable provisions contained in this section.

Sec. R324 BUILDING SECURITY.

Section R324.1. Scope. The provisions of this chapter shall apply to openings into dwelling units and to openings between attached garages and dwelling units. Door openings, including vehicular access doors in enclosed attached garages shall be in accordance with the provisions of this chapter.

Exceptions:

1. An opening in an exterior wall when all portions of such openings are more than 12 feet (3658 mm) vertically or 6 feet (1829 mm) horizontally from an accessible surface of any adjoining yard, court, passageway, public way, walk, breezeway, patio, planter, porch or similar area.

2. An opening in an exterior wall when all portions of such openings are more than 12 feet (3658 mm) vertically or 6 feet (1829 mm) horizontally from the surface of any adjoining roof, balcony, landing, stair tread, platform or similar structure or when any portion of such surface is itself more than 12 feet (3658 mm) above an accessible surface.

3. Any opening in a roof when all portions of such roof are more than 12 feet (3658 m) above an accessible surface.

4. Openings when the small dimension is 6 inches (152 mm) or less, provided that the closest edge of the opening is at least 36 inches (914 mm) from the locking device of the door or window assembly.

5. Openings protected by required fire door assemblies having a fire-endurance rating of not less than 45 minutes.

Sec. R324.2 SWINGING DOORS.

Section R324.2.1. General. Swinging doors shall be one of the following:

1. Wood flush-type door 1-3/4 inches thick minimum.

2. Wood panel-type door 1-3/4 inches thick minimum with all panels fabricated from material not less than 3/8 inch in thickness; provided all shaped portions of the panels are not less than 1/4 inch thick.

3. Ferrous metal doors of solid or hollow core construction with surfaces not less than 24 gauge in thickness.

4. Other metal doors with surfaces not less than the equivalent of 16 gauge sheet metal (0.06 inch) in thickness.

Section R324.2.2. Locking hardware. Single swinging doors and the active leaf of doors in pairs shall be equipped with an approved exterior key operating deadbolt or locking device as follows:

1. Strike deadbolts with a minimum throw of one inch and an embedment of not less than 5/8 inch into the holding device receiving the projected bolt.

2. Hook shape or expanding lug deadbolts with a minimum throw of 3/4 inch.

3. Deadbolts or locks which automatically activate two or more deadbolts with an embedment of not less than l/2 inch into the holding device receiving the projected bolts.

The inactive leaf of doors in pairs shall be equipped with manually or automatically operated hardened bolts at the top and bottom, with an embedment not less than 1/2 inch into the device receiving the projected bolt.

Cylinder guards shall be installed on all mortise or rim-type cylinder locks whenever the cylinder projects beyond the face of the door or is otherwise accessible to gripping tools.

Section R324.3 Windows. Window assemblies regulated by this chapter which are designed to be openable shall be constructed and installed so as to prohibit raising, sliding, or removal of the moving section while in the closed and locked position, unless such windows are protected by approved metal bars, screens or grilles. Louvered windows regulated by this chapter shall be protected by approved metal bars or grilles.

Section R324.4 Upward acting doors. Upward acting doors shall be secured with a cylinder lock, padlock with a hardened steel shackle and hardened steel hasp, metal slide bar, bolt or equivalent device, unless secured by electric power operation.

Cylinder guards shall be installed on all mortise or rim-type cylinder locks whenever the cylinder projects beyond the face of the door or is otherwise accessible to gripping tools.

Sec. R401. GENERAL.

Section R401.1 Application. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. In addition to the provisions of this chapter, the design and construction of foundations in areas prone to flooding as established by Table R301.2 (1) shall meet the provisions of Section R322. Wood foundations shall be designed and installed in accordance with AF&PA WPF. Where a design is not provided, the minimum foundation requirements for stud and concrete masonry bearing walls shall be as set forth in Table R403.1.

Exception: The provisions of this chapter shall be permitted to be used for wood foundations only in the following situations:

1. In buildings that have no more than two floors and a roof.
2. When interior basement and foundation walls are constructed at intervals not exceeding 50 feet (15 240 mm).

Wood foundations in Seismic Design Category D_0, D_1 or D_2 shall be designed in accordance with accepted engineering practice.

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection in accordance with the provisions in the Tempe City Code, Chapter 12. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), drains or swales shall be constructed in accordance with the provisions in the Tempe City Code, Chapter 12 to ensure drainage away from the structure. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

Sec. R403. FOOTINGS.

TABLE R403.1
FOUNDATIONS FOR STUD AND CONCRETE MASONRY BEARING WALLS – MINIMUM REQUIREMENTS.

Number of Floors Supported by the Foundation[3]	Thickness of Foundation Wall[2] (inches – Nominal Dimension)		Width of Footing[2,4] (W)\ (inches)		Thickness of Footing (inches)		Depth Below Undisturbed Soil (inches)
	Stud Wall						
	Concrete	Masonry[5]	Stud Wall[1]	Masonry Wall	Stud Wall	Masonry Wall	
1	6	6	12	16	6	8	12
2	8	8	15	20	7	8	18
3	10	8	18	24	8	8	24

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

1. Interior stud bearing walls may be supported by isolated footings. The footing width and length shall be twice the width shown in this table and the footings shall be spaced not more than 6 feet (1,829mm) on center.
2. A minimum of two (2) #4 reinforcing bars (minimum grade 40) are required in the footing/stem concrete. If metal hold downs are used, one #4 horizontal reinforcing bar must be placed within the top 6 of the stem wall.
3. Foundations may support a roof in addition to the stipulated number of floors. Foundations supporting roofs only shall be as required for supporting only one floor.
4. Isolated columns carrying loads in excess of 750 lbs shall be supported on minimum 4 square feet of footing, with minimum width of 24 inches. Maximum bearing pressure from service loads shall not exceed 1500 psf unless recommended by the soils report.
5. Foundation wall width may not be less than the width of the masonry wall.

Sec. R614. EARTHEN STRUCTURES.

Section R614.1 General. Earthen structures with any site condition may be designed with accepted engineering practice for earthen wall structures and with provisions of this section.

R614.1.1 earthen materials. This section shall establish minimum standards for safety for construction of earthen materials structures, collectively known as adobe, burnt adobe, rammed earth, and hydraulic pressed unit connection.

R614.1.2 professional registration required. Plans and specifications designed under the provisions of R614 shall be prepared by a registered professional architect or engineer licensed in the state for which the project is to be constructed.

Section R614.2 Minimum thickness. This minimum thickness of earthen structures shall be designed to limit tension to zero unless tensile reinforcement is provided. Walls shall be designed to meet forces prescribed by IBC Chapter 16. The measurement of height of walls shall be the distance between points of lateral support. Wall thickness shall be measured from face to face of each wall withe. The thickness of walls using racked joints shall be the surface to surface distance of the mortar joints. The withes of wall sections shall not be combined without cross bonding of the masonry units throughout the structural element. Cross bonding shall mean overlapping of not less than 1/3 of the dimension of the masonry units.

Section R614.3 Support conditions. Earthen structures shall be supported on a solid concrete, solid masonry foundation system the width of which shall be not greater than 1/6 inch narrower than the earthen structure which it supports. Earthen structures shall not be less than 6 inches above adjacent grade.

Section R614.4 Corbelled wall elements. The maximum corbelled projection beyond the face of the wall shall not be more than 4 inches. Such corbelled projections shall add additional thickness to the wall, the opposite face of the wall remaining plane with the primary wall plane.

Section R614.5 Moisture barrier. A moisture barrier equal to 30 lb, asphalt impregnated building paper, or equivalent moisture resistant barrier, shall be installed between the supporting foundation and the earthen material.

Section R614.6 Allowable stresses. Allowable compressive, tensile and shear stresses in earthen structures shall not exceed the values prescribed in table R614.6.A. In determining the stresses, the effects of all loads and conditions of loading and the influences of all forces affecting the design and strength of the several parts shall be considered. Bolt values shall not exceed those set forth in International Building Code Table 2109.3.3.1.

R614.6.1 Combined units. In walls composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the wall is composed. The net thickness of any facing unit of earthen materials used to resist stress shall not be less than 3 inches (76 mm).

When dissimilar materials, (e.g. concrete masonry or steel), is used to support earth wall construction, such elements shall be structurally isolated from other earth wall elements. The design shall recognize, with specific detailing, the effects shrinkage of the earth wall construction may have on the structural integrity of the structure.

Table R614.6.A
Allowable stresses for empirical design of earthen wall structures

Strength of unit, gross area		Allowable stresses Cross-sectional area	Note 1
Compression	300 psi	Normal loading Concentrated loading	30 psi 45 psi
Modulus of rupture	55 psi	Allowable tension without tensile reinforcing	0 psi
Shear	N/a	With special inspection Without special inspection	8 psi 4 psi
Modulus of elasticity	60,000 psi	Allowable deflection	Less than 1/2%

Notes:
1. Gross cross-sectional area shall be calculated on the actual rather than the nominal dimensions.

Section R614.7 Lateral support. Earthen walls shall be laterally supported in the vertical direction and at intersection with other earthen walls. Support at the top of the wall shall be in accordance with one of the methods in R614.7.1 or R617.7.2.

R614.7.1 Bond beams. A continuous bond beam system embedded in the earthen walls, designed to provide lateral support for the walls without the aid of additional bracing elements such as roof diaphragm. Bond beams of concrete or masonry shall be not less than the width of the wall, minus 6 inches (152 mm).

R614.7.1.1 Bond beam anchorage. Bond beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than the shear forces in both directions. The shear between a cast in place concrete bond beam and the earthen wall shall not exceed 1/8 the dead load at the base of the bond beam unless alternate attachment is provided compatible with the allowable stresses in Table R614.6.A or International Building Code Table 2109.3.3.1.

Section R614.7.2 Roof diaphragm. A roof diaphragm complying with other provisions of this code adequate to provide lateral support may be used to brace earthen walls. Anchorage shall be tie beams as specified in R614.7.2.2 or other anchorage methods of equal strength.

R614.7.2.1 tie beams. A tie beam is a beam built into the earthen wall for the purpose of anchoring the roof diaphragm and transferring the lateral perpendicular and parallel forces. Tie beams shall be provided for all earthen walls laterally braced by a roof diaphragm.

R614.7.2.2 tie beam anchorage. Tie beams shall be anchored to earthen walls at intervals of not over 48 inches (1219 mm) by a connection with shear strength of not less than the shear forces in both directions. The shear between a cast in place concrete or masonry tie beam and the earthen wall shall not exceed 1/8 the dead load at the base of the bond beam unless alternate attachment is provided compatible with the allowable stresses in Table R614.6.A or International Building Code Table 2109.3.3.1.

Section R614.8 Lintels. Earthen walls over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or earthen material arches designed to support load imposed. Lintels shall not be supported by rigid structural columns, frames or posts with rigidities greater than the earthen wall unless the design allows for

the potential for differential settlements. Small openings less than 12 inches may be constructed without structural lintels.

Section R614.9 Shear walls. Earthen walls subject to in-plane loads shall be designed to be tension free unless tensile reinforcement is provided. Solid panels less than 4 feet (1219 mm) shall not be considered shear walls.

Section R614.10 Opening jambs. Portions of walls between openings shall be constructed with lengths of not less than 1 1/2 times the thickness of the wall in which they occur.

Section R614.11 Freestanding piers. Piers independent of earthen walls shall be designed to support vertical and horizontal loads unless braced by other elements of the structure. Tensile reinforcement shall be provided where tension occurs. When structural posts or columns are provided within the pier or attachments shall be provided to the earthen wall system to laterally secure it.

R614.11.1 Pier cap. A solid concrete cap shall be provided at the top of load bearing piers under all concrete loads. The cap shall cover not less than 50% of the top pier.

Section R614.12 Chases. Chases and recesses in earthen walls shall not be deeper than 1/3 the thickness of the wall thickness. The maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm), and shall have at least 8 inches (203 mm) of earthen construction in back of the chases and recesses and between adjacent chases or recesses and at least 12 inches (305 mm) between the chase and the jambs of openings.

Chases and recesses in earthen walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Earthen walls directly above chases or recesses wider than 16 inches (406 mm) shall not be supported on non-combustible lintels.

Section R614.13 Stack bond. When the earthen wall is constructed of units, (e.g. adobe brick), units shall not be laid in stack bond. Units shall, in all locations throughout the wall system, overlap the courses below by not less than 1/3 the dimension of the unit.

Exception: Ornamental non-structural elements may be laid in stack bond if properly tied to the main structure.

Section R614.14 Metal reinforcement. All walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of at least 9 gage when using earthen units, (e.g. adobe block). Horizontal reinforcement shall be used throughout the wall system and be continuous at the intersections. Reinforcement used throughout the wall system shall be not more than 4 inches narrower than the wall thickness.

Section R614.15 Veneer. All veneers using earthen materials shall be installed in accordance with this section. Such veneers shall be installed with a non-combustible foundation, over concrete masonry, a backing of wood or cold-formed steel and the veneer shall be not less than 4 inches (101 mm) or greater than 8 inches (203 mm) in thickness.

R614.15.1 Anchorage. Earthen units shall be anchored to the supporting wall with a corrosion-resistant veneer tie system mechanically attached to continuous horizontal joint reinforcement continuously installed in the veneer bed joint not less than 16 inches (406 mm) on center vertically. When earth mortar systems are used, the tie system shall prevent the accumulation of mortar at the base of the veneer. Conventional brick ties shall not be used to anchor earth units.

R614.15.2 Air space. The veneer shall be separated from the sheathing by an air space of a minimum of 1 inch (25 mm) but not more than 2 inches (51 mm). A weather-resistant membrane of 15 pound asphalt-saturated felt shall be provided except when veneer is applied over concrete masonry or concrete backing.

R614.15.3 Flashing. Approved corrosion-resistive flashing shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water into the building structural framing components. The flashing shall extend to the surface of the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Flashing shall be located beneath the first course of veneer, and at other points of support, including structural floors, shelf angles and lintels. Approved corrosion-resisting flashing shall be installed at all of the following locations:

1. At top of all exterior window and door openings in such a manner as to be leak proof.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projection lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
5. At wall and roof intersections.

R614.15.4 Weep holes. Weep holes shall be provided in the outside withe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weep holes shall not be less than 3/16 inches (4.8 mm) in diameter. Weep holes shall be located immediately above the flashing.

Section R614.16 Buttresses. Earthen walls used as buttresses shall not extend beyond an average length perpendicular to the wall to be braced a distance of 6 feet (1830 mm) without consideration to out-of-plane bending of the buttress.

Section R614.17 Gable end walls. Gable end walls shall be constructed using veneer construction as required by R614.15 or shall be provided with lateral bracing to prevent overturn.

Section R614.18 Ledgers. Ledgers shall not be used to support vertical live and dead loads in excess of 75 pounds per lineal foot unless the tension in the wall fur to bending from out-of-plane loads and the eccentric load from the ledger is zero.

Section R614.19 Material standards. The materials used in earthen wall structures shall comply with the following material standards. For each of the tests prescribed in theses standards, five full size sample units shall be selected at random from each lot of units of fraction thereof produced. Mass wall systems such as rammed earth shall provide five tests for each required standard test series.

R614.19.1 Manufacturers of earthen materials. Established manufacturers of earthen materials shall certify compliance with these standards. Copies of their periodic testing shall be supplied to the manufacturer to designers and users of earthen materials shall include the actual dimensions of units, not nominal dimensions.

R614.19.2 Onsite earthen materials. Earthen units, mortar, rammed earth wall materials mined, mixed, formulated, and/or molded on site shall be tested for compliance with these standards. For individual structures, a set of tests shall be provided for the first 2500 square feet of wall and an additional test for each additional 2500 square feet or portion thereof in the structure. At least one set of tests shall be made for each structure and for each 2500 square feet of patio wall. The fabricator of the materials used in the project shall certify in writing to the building official compliance with these standards. The certification shall include the number of units site molded, size of the units, volume of material used as mortar, dates of fabrication, and results of testing of the material. If materials from established manufacturers and onsite materials are used in the project, copies of records including sources, quantities, and location of use within the structure shall be provided to the building official upon request.

R614.19.3 Categories of earthen materials. Type I, II, III, and IV earthen materials are approved for use in construction of projects designed in accordance with R614.

Exception: Type I adobe shall only be used for repairs and small additions in which new walls do not exceed 10% of the surface area of existing walls of Type I construction and for structures constructed of a similar material system and for projects requiring this class of materials to meet historic guidelines.

R614.19.3.1 Required plaster veneer. Adobe of Type I and II shall be protected on the exterior with exterior plaster meeting the requirements of IBC Section 2512 applied over wire lath. Type I and II adobe shall not be used within 4 inches (102 mm) of the floor or at the top of parapet walls or near potential sources of water which may affect the stability of the earth wall system. Other types of adobe may be left unplastered and may be used without separation from the floor.

R614.19.3.2 Adobe units and mortar. Moisture resistant stabilized adobe units and mortar shall meet the following testing standards as indicated in Table R614.19.3.2. Type S Portland cement mortar may be used for Type II, III, and IV adobe in lieu of earth mortar.

Table R614.19.3.2

Material type	Dry compression 614.19.3	Wet compression 614.19.4	Modulus of rupture 614.19.5	Absorption <2.5% 614.19.6	Absorption <5.0% 614.19.7	Moisture content 614.19.8.1
I	X		X			X
II	X		X		X	X
III	X		X	X		X
IV		X	X			X

"X" indicates that material must pass the test standards prescribed in the section.

R614.19.3.3 dry compression strength. Determine the compressive strength of the required number of samples as required by R614.19 in accordance with the following procedures.

R614.19.3.3.1 Dry the specimen. Dry the specimen at a temperature of 85°F +- 15°F (29°C +- 9°C) in an atmosphere having relative humidity of not more than 50 percent. Weigh the specimen at one-day intervals until constant weight is attained.

R614.19.3.3.2 Cap the specimen. The specimen may be suitably capped with calcined gypsum mortar or the bearing surfaces may be rubbed smooth and true. Then calcined gypsum is used for capping, conduct the test after the capping has set and the specimen has been dried to constant weight in accordance with item 1 of this section.

R614.19.3.3.3 Test the specimen. Test the specimens in the position in which the earthen unit is designed to be used. And bed on and cap with a felt pad not less then one-eighth (1/8) inch (3.2 mm) or more than one-fourth (1/4) inch (6.4 mm) in thickness.

R614.19.3.3.4 Testing equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 0.05 inches (1.27 mm) per minute.

R614.19.3.3.5 Reporting results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Units shall have an average dry compressive strength of 300 psi (2068 kPa) and no individual unit may have a strength of less than 250 psi (1724 kPa).

R614.19.4 Wet compression strength. Determine the compressive strength of the required number of specimen as required by R614.19 in accordance with the following procedures:

R614.19.4.1 Cap the specimen. The specimens may be suitably capped with a capping material compatible with water saturation or the bearing surfaces may be rubbed smooth and true.

R614.19.4.2 Wetting the specimen. Submerge the specimen under water for not less than 8 (eight) hours or longer as required, until fully saturated.

R614.19.4.3 Test the specimen. Immediately test the specimen in the position in which the earthen unit is designed to be used. Bed on and cap with a felt pad not less than 1/8 inch (3.2 mm) or more than 1/4 inch (6.4 mm) in thickness.

R614.19.4.4 Testing equipment. The loading head shall completely cover the bearing area of the specimen and the applied load shall be transmitted through a spherical bearing block of proper design. The speed of the moving head of the testing machine shall not be more than 0.05 inches (1.27 mm) per minute.

R614.19.4.5 Reporting results. Calculate the average compressive strength of the specimens tested and report this as the compressive strength of the block. Adobe units shall have an average wet compressive strength of 300 psi (2068 kPa). Five samples shall be tested and no individual unit may have a wet compressive strength of less than 250 psi (1724 kPa).

R614.19.5 Modulus of rupture. Adobe units shall have an average modulus or rupture of 50 psi (345 kPa) when tested in accordance with the following procedures. Five samples shall be tested and no individual unit shall have a modulus of rupture less than 35 psi (241 kPa)

R614.19.5.1 Support conditions. A cured unit shall be simply supported by 2 inch diameter (51 mm) cylindrical support located 2 inches (51 mm) in from each end and extending the full width of the unit.

R614.19.5.2 Loading conditions. A 2 inch diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

R614.19.5.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

R614.19.5.4 modulus of rupture determination. The modulus of rupture shall be determined by the following formula:

Equation R614.19.5.4.1

$$Fr = 3WLs/2bt2$$

Where, for this purpose of this section only:

B = width of the test specimen measured parallel to the loading cylinder, inches (mm)
Fr = modulus of rupture, psi (Mpa)
Ls = distance between supports, inches (mm)
T = thickness of the test specimen measured parallel to the distance of load, inches (mm)
W = The applied load at failure, pounds (N)

R614.19.6 Absorption less than 2.5%. A 4 inch (102 mm) cube, cut from an adobe unit fired to a constant weight in a ventilated oven at 212° F to 239° F, shall not absorb more then 2 1/2 percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

R614.19.7 Absorption less than 5.0%. A 4 inch (102 mm) cube, cut from an adobe unit fired to a constant weight in a ventilated oven at 212° F to 239° F, shall not absorb more then 2 1/2 percent moisture by weight when placed upon a constantly water-saturated, porous surface for 7 days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

R614.19.8 Additional requirements. All earthen units shall meet the following requirements:

R614.19.8.1 Moisture content requirements. Earthen units shall have a moisture content not exceeding 4 percent by weight at the time of use.

R614.19.8.2 Shrinkage cracks. All earthen units shall not contain more than three shrinkage cracks and any single shrinkage cracks shall not exceed 3 inches (76 mm) in length or 1/8 inch (3.2 mm) in width.

R614.19.8.3 Soil requirements. Soil used for moisture resisting adobe units and mortar shall be chemically compatible with the stabilizing material. The soil shall contain sufficient clay to bind the particles together without the air of stabilizers. The soil shall contain not more than 0.2 percent of water-soluble salts.

R614.19.9 Cement stabilized rammed earth. Cement stabilized rammed earth shall meet the following standards. The installer of the wall system shall comply with the requirements of R614.19.2 for frequency testing.

R614.19.9.1 Testing before construction. The installer of cement stabilized rammed earth shall provide the following testing before issuance of a building permit.

R614.19.9.2 Materials from a licensed sand and gravel producer. A copy of Proctor ASTM D 698 shall be provided for each soil type and source or combination of sources. Periodic testing as provided by the supplier may be supplied to meet this requirement. The soil shall contain not more than 0.2 percent of water-soluble salts.

R614.19.9.3 Material mined and mixed on site. A copy of ASTM D 698, ASTM C 117, ASTM C 136, and ASTM D 4318 shall be provided for each soil type and source or combination of sources. Such testing shall be repeated as required to assure that all materials to be used have been tested and are represented by the tests. The soil shall contain not more than 0.2 percent of water-soluble salts.

R614.19.9.4 Testing required during construction. The installer of cement stabilized rammed earth shall provide the following tests made during the construction process. A certified testing laboratory shall provide field density tests for comparison to the pre-construction Proctor ASTM D 698, percent moisture ASTM D 2216, dry density ASTM D 698, and percent moisture ASTM D 1556.

Cement stabilized rammed earth walls shall meet or exceed 95% maximum dry density (ASTM D 698). Samples taken from the wall shall exceed 300 psi compression (ASTM D 1633) 14 days after placement.

Sec. R702. INTERIOR COVERING.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD

THICKNESS OF GYPSUM BOARD (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING[c]
				Nails[a]	Screws[b]	
1/2	Ceiling	Either direction	16	7	12	13 gage, 1-3/8 long, 19/64 head; 0.098 diameter, 1-1/4 long, annular-ringed; 5d cooler nail, 0.086 diameter, 1-5/8 long, 15/64 head; or gypsum board nail, 0.086 diameter, 1-5/8 long, 9/32 head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
5/8	Ceiling	Either direction	16	7	12	13 gage, 1-5/8 long, 19/64 head; 0.098 diameter, 1-3/8 long, annular-ringed; 6d cooler nail, 0.092 diameter, 1-7/8 long, ¼ head; or gypsum board nail 0.0915 diameter, 1-7/8 long, 19/64 head.
	Ceiling[e]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
Application with adhesive						
1/2 or 5/8	Ceiling	Perpendicular	16	16	16	Same as above for 1/2 and 5/8 gypsum board, respectively
	Ceiling[d]	Either direction	24	12	16	
	Wall	Either direction	24	16	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than $2^{1}/_{2}$ inches apart may be used with the pair of nails spaced 12 inches on center.

b. Screws shall be in accordance with Section R702.3.6. Screws for attaching gypsum board to structural insulated panels shall penetrate the wood structural panel facing not less than $^{7}/_{16}$ inch.
c. Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than $^{5}/_{8}$ inch longer than the gypsum board thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13½ gage, $1^{5}/_{8}$ inches long, $1^{5}/_{64}$-inch head for $^{1}/_{2}$-inch gypsum board; and 6d, 13 gage, $1^{7}/_{8}$ inches long, $1^{5}/_{64}$-inch head for $^{5}/_{8}$-inch gypsum board.
d. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be $^{1}/_{2}$-inch for 16-inch on center framing and ⅝-inch for 24 inch on center framing or $^{1}/_{2}$-inch sag-resistant gypsum ceiling board shall be used.
e. Type X gypsum board for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum 6 inches O.C. by minimum $1\text{-}^{7}/_{8}$ inches 6d coated nails or equivalent drywall screws.

Sec. R1007. CLEAN BURNING FIREPLACES.

Section R1007.1 Clean Burning Fireplaces. The purpose of this standard is to regulate fireplaces, woodstoves, or other solid-fuel burning devices to reduce the amount of air pollution caused by particulate matter and carbon monoxide.

The effective date of the regulations and prohibitions set forth in this standard took effect on December 31, 1998.

Definitions: For purposes of this standard, the following words and terms shall be defined as follows:

FIREPLACE means a built in place masonry hearth and fire chamber or a factory-built appliance, designed to burn solid fuel or to accommodate gas or electric log insert or similar device, and which is intended for occasional recreational or aesthetic use, not for cooking, heating, or industrial processes.

SOLID FUEL includes but is not limited to wood, coal, or other nongaseous or non-liquid fuels, including those fuels defined by the Maricopa County Air Pollution Control Officer as inappropriate fuel to burn in residential wood-burning devices.

WOODSTOVE means a solid-fuel burning heating appliance including a pellet stove, which is either freestanding or designed to be inserted into a fireplace.

Section R1007.2. Installation restrictions. On or after the effective date, no person, firm or corporation shall construct or install a fireplace or a woodstove, and the building official shall not approve or issue a permit to construct or install a fireplace or a woodstove, unless the fireplace or woodstove complied with one of the following:

1. A fireplace which has a permanently installed gas or electric log insert.

2. A fireplace, woodstove, or other solid-fuel burning appliance which has been certified by the United States Environmental Protection Agency as conforming to 40 Code of Federal Regulations Part 60, Subpart AAA as in effect on July 1, 1990.

3. A fireplace, woodstove or other solid-fuel burning appliance which has been tested and listed by a nationally recognized testing agency to meet performance standards equivalent to those adopted by 40 Code of Federal Regulations Part 60, Subpart AAA as in effect on July 1, 1990.

4. A fireplace, woodstove or other solid-fuel burning appliance which has been determined by the Maricopa County Air Pollution Control Officer to meet performance standards equivalent to those adopted by 40 Code of Federal Regulations Part 60, Subpart AAA as in effect on July 1, 1990.

5. A fireplace which has a permanently installed woodstove insert which complies with subparagraphs 2, 3, or 4 above.

Section R1007.3. The following installations are not regulated by this standard and are not prohibited by this standard:

1. Furnace, boilers, incinerators, kilns, and other similar space heating or industrial process equipment.

2. Cook-stoves, barbecue grills, and similar appliances designed primarily for cooking.

3. Fire pits, barbecue grills, and other outdoor fireplaces.

Section R1007.4. Fireplace or Woodstove Alterations Prohibited:

Section R1007.4 .1. On or after the effective date, no person, firm or corporation shall alter or remove a gas or electric log insert or a woodstove insert from a fireplace for purposes of converting the fireplace to directly burn wood or other solid fuel.

Section R1007.4 .2. On or after the effective date, no person, firm or corporation shall alter a fireplace, woodstove or other solid fuel burning appliance in any manner that would void its certification or operational compliance with the provisions of this standard.

Section R1007.5. Permits Required. In addition to the provisions and restrictions of this standard, construction, installation or alteration of all fireplaces, woodstoves and other gas, electric or solid-fuel burning appliances and equipment shall be done in compliance with provisions of this Code and shall be subject to the permits and inspections.

Sec. M1307. APPLIANCE INSTALLATION.

Section M1307.3. Elevation of ignition source. Appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in garages. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

1. Elevation of the ignition source is not required for appliances that are listed as flammable vapor resistant and for installation without elevation.

2. Direct-vent appliances that obtain all combustion air directly from the outdoors.

3. Clothes dryers installed in private garages.

Section M1307.7. Liquefied Petroleum Appliances. LPG appliances shall not be installed in an attic, pit or other location that would cause a ponding or retention of gas.

Sec. G2406. APPLIANCE LOCATION.

Section G2406.2 (303.3). Prohibited locations. Appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets or surgical rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following:

1. The appliance is a direct-vent appliance installed in accordance with the conditions of the listing and the manufacturer's instructions.
2. Vented rooms heaters, wall furnaces, vented decorative appliances, vented gas fireplaces, vented gas fireplace heaters and decorative appliances for installation in vented solid fuel-burning fireplaces are installed in rooms that meet the required volume criteria of Section G2407.5.
3. A single wall-mounted unvented room heater is installed in a bathroom and such unvented room heater is equipped as specified in Section G2445.6 and has an input rating not greater than 6,000 Btu/h (1.76 kW). The bathroom shall meet the required volume criteria of Section G2407.5.
4. A single wall-mounted unvented room heater is installed in a bedroom and such unvented room heater is equipped as specified in Section G2445.6 and has an input rating not greater than 10,000

Btu/h (2.93 kW). The bedroom shall meet the required volume criteria of Section G2407.5.

5. The appliance is installed in a room or space that opens only into a bedroom or bathroom, and such room or space is used for no other purpose and is provided with a solid weather-stripped door equipped with an approved self-closing device. All combustion air shall be taken directly from the outdoors in accordance with Section G2407.6.
6. Liquefied Petroleum (LPG) appliances shall not be installed in an attic, pit or other location that would cause ponding or retention of gas.

Sec. G2407 (304) COMBUSTION, VENTILATION AND DILUTION AIR (Editorial Section changes)

Section G2407.1.1. Prohibited sources. Combustion air ducts and openings shall not connect appliance enclosures with space in which the operation of a fan may adversely affect the flow of combustion air. Combustion air shall not be obtained from an area in which flammable vapors present a hazard. Fuel-fired appliances shall not obtain combustion air from any of the following rooms or spaces:

1. Sleeping rooms.
2. Bathrooms.
3. Toilet rooms.

Exception: The following appliances may be located in sleeping rooms, bathrooms and toilet rooms:

1. Appliances installed in an enclosure in which all combustion air is taken from the outdoors and the enclosure is equipped with a solid weather-stripped door and self-closing device.
2. Direct-vent appliances that obtain all combustion air directly from the outdoors.

Section G2407.11 (304.11) Combustion air ducts. Combustion air ducts shall comply with all of the following:

1. Ducts shall be constructed of galvanized steel complying with Chapter 16 or of a material having equivalent corrosion resistance, strength and rigidity.

   Exception: Within dwellings units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.
2. Ducts shall terminate in an unobstructed space allowing free movement of combustion air to the appliances.
3. Ducts shall serve a single enclosure.
4. A single duct shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
5. Ducts shall not be screened where terminating in an attic space.
6. Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.
7. The remaining space surrounding a chimney liner, gas vent, special gas vent or plastic piping installed within a masonry, metal or factory-built chimney shall not be used to supply combustion air.

   Exception: Direct-vent gas-fired appliances designed for installation in a solid fuel-burning fireplace where installed in accordance with the manufacturer's instructions.
8. Combustion air intake openings located on the exterior of a building shall have the lowest side of such openings located not less than 12 inches (305 mm) vertically from the adjoining finished ground level.
9. For LPG appliances, any duct serving the lower opening shall be at the floor level and slope to the outdoors without traps or pockets.

Sec. G2408. INSTALLATION.

Section G2408.2 (305.3). Elevation of ignition source. Equipment and appliances having an ignition source shall be elevated such that the source of ignition is not less than eighteen (18) inches (457 mm) above the floor in hazardous locations and public garages, private garages, repair garages, motor fuel-dispensing facilities and parking garages. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exceptions:

1. Elevation of the ignition source is not required for appliances that are listed as flammable vapor resistant and for installation without elevation.

2. Direct-vent appliances that obtain all combustion air directly from the outdoors.

3. Clothes dryers installed in private garages.

Sec. G2415. PIPING SYSTEM INSTALLATION.

G2415.4.1 (404.4.1) Underground piping. No gas piping shall be permitted under an asphalt, concrete or other paved surface that adjoins any building or structure unless installed in a gas-tight conduit or other approved method of venting is provided.

The conduit shall be of wrought iron, plastic pipe, steel pipe or other approved conduit material. The conduit shall be protected from corrosion in accordance with Section G2415.9. The interior diameter of the conduit shall be not less than one-half inch larger than the outside diameter of the gas pipe within. The conduit shall extend to a point not less than 12 inches (305 mm) beyond or 4 inches (102 mm) above the paved surface. The ends shall not be sealed.

Section G2415.10 (404.10). Minimum burial depth. Underground piping systems shall be installed a minimum depth of 12 inches (305 mm) below grade, for metal piping, and 18 inches for plastic piping.

G2415.10.1 (404.10.1) Individual outside appliances IS DELETED.

Sec. G2417. INSPECTION, TESTING AND PURGING.

Section G2417.4. (406.4) Test pressure measurement. Test pressure shall be measured with a manometer or with a pressure-measuring device designed and calibrated to read, record, or indicate a pressure loss caused by leakage during the pressure test period. The source of pressure shall be isolated before the pressure tests are made.

G2417.4.1 (406.4.1) Test pressure. The test pressure to be used shall be no less than ten (10) pounds per square inch (69 kPa) gauge pressure, or where approved by the building official, the piping and valves may be tested at a pressure of at least six (6) inches (152.4 mm) of mercury, measured with a manometer or slope gauge. For welded piping, and for piping carrying gas at pressures in excess of fourteen (14) inches (0.4 m) water column pressure, the test pressure shall be no less than sixty (60) pounds per square inch (413 kPa). Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

G2417.4.2 (406.4.2) Test duration. Test duration shall be not less fifteen (15) minutes or for welded pipe and piping carrying gas at pressures in excess of fourteen (14) inches (0.4 m) water column pressure, the test duration shall be not less than thirty (30) minutes. The duration of the test shall not be required to exceed 24 hours.

G2417.4.3 (406.4.3) Test gauges. Tests required by this Code which are performed utilizing dial gauges shall be limited to gauges having the following pressure increments or graduations.

G2417.4.3.1. (406.4.3.1) Required pressure tests of ten (10) pounds (69 kPa) or less shall be performed with gauges having increments of one-tenth (1/10) pound (0.69 kPa) or less.

G2417.4.3.2. (406.4.3.2) Required pressure tests exceeding ten (10) pounds (69 kPa) but less than one hundred (100) pounds (690 kPa) shall be performed with gauges having increments of one pound (7 kPa) or less.

G2417.4.3.3. (406.4.3.3) Required pressure tests exceeding one hundred (100) pounds (690 kPa) shall be performed with gauges having increments 2 psi (14 kPa) or less.

G2417.4.3.4 (406.4.3.4) Pressure tests required by this code, which are performed utilizing dial gauges, shall be limited to a gauge having a maximum gauge rating not exceeding twice the applied test pressure.

Sec. P2503. INSPECTION AND TESTS.

Section P2503.9. Test gauges. Gauges used for testing shall be as follows:

1. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
2. Tests requiring a pressure of 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
3. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.

Pressure tests required by this code, which are performed utilizing dial gauges, shall be limited to a gauge having a maximum gauge rating not exceeding twice the applied test pressure.

Sec. P2603. STRUCTURAL AND PIPING PROTECTION.

Section P2603.6.1. Sewer depth. Building sewers shall be a minimum of 12 inches (305 mm) below grade.

Sec. P2801. GENERAL.

*Section P2801.5.1. Pan size and drain***.** The pan shall not be less than 1½ inches (38 mm) deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a minimum diameter of ¾ inch (19 mm) installed with a uniform alignment at a uniform slope in the direction of discharge of not less than one-eighth unit vertical in 12 units' horizontal (one-percent slope). Piping for safety pan drains shall be of those materials listed in Table P2905.5.

Sec. P2803. RELIF VALVES.

Section P2803.6.1. Requirements of discharge pipe. The discharge piping serving a pressure-relief valve, temperature-relief valve or combination valve shall:

1. Not be directly connected to the drainage system.
2. Discharge in a downward direction.
3. Not be smaller than the diameter of the outlet of the valve served and shall discharge full size to the air gap.
4. Serve a single relief device and shall not connect to piping serving any other relief device or equipment.

5. Discharge through an air gap to the floor, to the pan serving the water heater or storage tank, to a waste receptor or to the outdoors.
6. Discharge in a manner that does not cause personal injury or structural damage.
7. Discharge to a termination point that is readily observable by the building occupants.
8. Not be trapped.
9. Be installed to flow by gravity.
10. Terminate not less than 6 inches (152 mm) and not more than 12 inches (610 mm) above finished grade, the floor or waste receptor.
11. Not have a threaded connection at the end of the piping.
12. Not have valves or tee fittings.
13. Be constructed of those materials listed in Section P2904.5 or materials tested, rated and approved for such use in accordance with ASME A112.4.1.

Sec. P2903 WATER-SUPPLY SYSTEM

P2903.7 Size of water-service mains, branch mains and risers. The minimum size water service pipe shall be 3/4 inch (19 mm). The size of water service mains, branch mains and risers shall be determined according to water supply demand [gpm (L/m)], available water pressure [psi (kPa)] and friction loss caused by the water meter and developed length of pipe [feet (m)], including equivalent length of fittings. The size of each water distribution system shall be determined according to the methods in Appendix P or when approved by the code official, to design methods conforming to acceptable engineering practice.

Sec. P2904 DWELLING UNIT FIRE SPRINKLER SYSTEMS IS DELETED.

Sec. P3001 GENERAL.

Section P3001.4. Sewer required. Every building in which plumbing fixtures are installed and all premises having drainage piping shall be connected to a public sewer, where available, or an approved private disposal system in accordance with the Maricopa County Health Department Environmental Service Division. The public sewer may be considered as not being available only when so determined by the Maricopa County Health Department Environmental Service Division.

Sec. E3603 SERVICE, FEEDER AND GROUNDING ELECTRODE CONDUCTOR SIZING.

Table E3603.1
SERVICE CONDUCTORS AND GROUNDING ELECTRODE CONDUCTOR SIZING

Conductor Types and Sizes for 120/240-Volt and 120/208-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. Conductor Types RH, RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, SE, USE, USE-2					
Copper (AWG or kcmil)	Aluminum or Copper-Clad Aluminum (AWG or kcmil)	Service or Feeder Rating (Amperes)		Min. Grounding Electrode Conductor size[a] (AWG)	
		≤ 30°C	> 30°C	Copper	Aluminum
4	2	100	----	8[b]	6[c]
3	1	110	----	8[b]	6[c]
2	1/0	125	100	8[b]	6[c]
1	2/0	150	125	6[c]	4
1/0	3/0	175	150	6[c]	4

2/0	4/0	200	175	4	2
3/0	250	225	200	4	2
4/0	300	250	225	2[d]	1/0[d]
250	350	300	250	2[d]	1/0[d]
350	500	350	300	2[d]	1/0[d]
400	600	400	350	1/0[d]	3/0[d]

a. Where protected by a metal raceway, grounding electrode conductors shall be electrically bonded to the metal raceway at both ends.
b. No. 8 AWG grounding electrode conductors shall be protected with metal conduit or nonmetallic conduit.
c. Where not protected, No. 6 AWG grounding electrode conductors shall closely follow a structural surface for physical protection. The supports shall be spaced not more than 24 inches on center and shall be within 12 inches of any enclosure or termination.
d. Where the sole grounding electrode system is the footing steel as covered in Section E3608.1.2, the grounding electrode conductor shall not be required to be larger than No. 4 copper conductor.

CAUTION - UTILITY COMPANY CONDUCTOR SIZE REQUIREMENTS MAY VARY. CONSULT WITH SERVING UTILITY PRIOR TO INSTALLATION.

Sec. E3701 GENERAL.

Section E3701.1. Scope. This chapter covers branch circuits and feeders and specifies the minimum required branch circuits, the allowable loads and the required overcurrent protection for branch circuits and feeders that serve less than 100 percent of the dwelling unit load. Feeder circuits that serve 100 percent of the dwelling load shall be sized in accordance with the procedures in Chapter 36. Aluminum conductors smaller than #8 shall not be used for lighting or power circuits indoors.

Sec. E3908. GROUNDING.

*Section E3908.8. Types of Equipment Grounding Conductors***.** The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:

1. A copper or other corrosion-resistant conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a busbar of any shape.

2. Threaded rigid metal conduit and fittings.

3. Threaded Intermediate metal conduit and fittings.

4. Electrical metallic tubing with an individual equipment grounding conductor.

5. Flexible metal conduit with an individual equipment grounding conductor or where both the conduit and fittings are listed for grounding.

6. Armor of Type AC cable with an individual equipment grounding conductor.

7. Surface metal raceway.

8. Metal-clad cable with an individual equipment grounding conductor or, where both the cable and fittings are listed for grounding.

9. Liquid-tight flexible metal conduit with an individual equipment grounding conductor or where both the conduit and fittings are listed for grounding.

CHAPTER 42 SWIMMING POOLS

E4201.2 Definitions.

PERMANENTLY INSTALLED SWIMMING, WADING, IMMERSION AND THERAPEUTIC POOLS. Those that are constructed in the ground or partially in the ground, and all others capable of holding

water with a depth greater than 18 inches (430 mm), and all pools installed inside of a building, regardless of water depth, whether or not served by electrical circuits of any nature.

Sec. E4203 EQUIPMENT LOCATION AND CLEARANCES

E4203.8 Mechanical and electrical equipment location. Mechanical and electrical equipment not addressed in other sections in Chapter 42, shall not be permitted within the area extending 6 feet (1.83 m) horizontally from the inside wall of the pool.

Exception: Listed swimming pool covers where the electrical equipment is part of the total assembly.

(FPN): In determining the above dimension, the distance to be measured is the shortest path to the equipment without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other similar effective permanent barrier.

CHAPTER 43 CLASS 2 REMOTE-CONTROL, SIGNALING AND POWER-LIMITED CIRCUITS

Sec. E4302 POWER SOURCES

E4302.3 Bell and signal transformers. In dwelling units, bell and signal transformers shall not be installed in attics, closets or in any inaccessible concealed place.

Appendix G SWIMMING POOLS, SPAS, AND HOT TUBS.

Sec. AG101 GENERAL

AG101.2 Pools in flood hazard areas. Pools that are located in flood hazard areas established by Table R301.2(1), including above-ground pools, on-ground pools and in-ground pools that involve placement of fill, shall comply with Tempe City Code, Chapter 12.

AG101.2.1 Pools located in designated storm water retention areas. Where pools are located in design storm water retention areas, the construction of the pool shall comply with Tempe City Code, Chapter 12.

Sec. AG102 DEFINITIONS

SWIMMING POOL. Any structure intended for swimming or recreational bathing that contains water over 18 inches (430 mm) deep. This includes in-ground, aboveground, and on-ground swimming pools, hot tubs, and spas.

Sec AG105 BARRIER REQUIREMENTS

Section AG105.2. Outdoor swimming pool.

1. The top of the barrier shall be at least 5 feet (1525 mm) above grade measured on the side of the barrier that faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be 2 inches (51mm) measured on the side of the barrier that faces away from the swimming pool. Where the top of the pool structure is above grade, such as an aboveground pool, the barrier may be at ground level, such as the pool structure, or mounted on the top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be 4 inches (102 mm).
2. N/C
3. N/C
4. N/C
5. N/C
6. N/C
7. N/C

8. N/C
9. Where a wall of a dwelling serves as part of the barrier, one of the following conditions shall be met:
   9.1 The pool shall be equipped with a powered safety cover in compliance with ASTM F 1346; or
   9.2 Doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and/or its screen, if present, are opened. The alarm shall be listed and labeled in accordance with UL 2017. The audible alarm shall activate within 7 seconds and sound continuously for a minimum of 30 seconds after the door and/or its screen, if present, are opened and be capable of being heard throughout the house during normal household activities. The alarm shall automatically reset under all conditions. The alarm system shall be equipped with a manual means, such as touch pad or switch, to temporarily deactivate the alarm for a single opening. Deactivation shall last for not more than 15 seconds. The deactivation switch(es) shall be located at least 54 inches (1372 mm) above the threshold of the door; or
   9.3 Other means of protection, such as self-closing doors with self-latching devices, which are approved by the governing body, shall be acceptable as long as the degree of protection afforded is not less than the protection afforded by Item 9.1 or 9.2 described above.
10. N/C

Section AG105.5. Barrier exceptions:

1. Spas or hot tubs with a safety cover which complies with ASTM F 1346, as listed in Section AG107, shall be exempt from the provisions of this appendix.
2. Where the premises upon which a swimming pool, spa, or hot tub is located adjoins that body of water recorded as Tract S of The Lakes, an enclosure parallel to the bank is not required; provided, that an abutting enclosure, conforming to AG105, extends horizontally to the lakeside edge of the lake bank or beyond. For purposes of this exception, the word abutting shall mean terminating at the point of contact with the lakeside edge of the bank.

Section AG105.6 Unenclosed pools. It is hereby declared to be a public nuisance and dangerous to the public health, safety, and welfare to maintain an outdoor swimming pool, spa or hot tub in the city unless enclosed in accordance with AG105, It shall be the responsibility of both the property owner and the occupant of the premises to install and maintain the fences, locks, latches, alarms, and gates in good condition and proper working order when water is in the pool, and either or both may be deemed in violation of this chapter for failure to do so.

Section AG105.7. Prerequisites to issuance of building permit. A building permit shall not be issued for any swimming pool, spa or hot tub unless the plans for such pool provide for an enclosure as required by this article.

Section AG105.8. Final inspection and approval. No swimming pool, spa or hot tub shall be filled in whole or in part with water unless the pool enclosure has been installed in accordance with this article and approved by the Community Development Director or authorized representative.

Appendix K. SOUND TRANSMISSION.

Sec. Appendix, K102 AIR-BORNE SOUND

Section AK102.1 General. Airborne sound insulation for walls and floor-ceiling assemblies separating dwelling units from each other shall meet a Sound Transmission Class (STC) rating of no less than 50 (45 if field tested) when tested in accordance with ASTM E 90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilation or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required rating. Dwelling unit entrance doors, which share a common space, shall be tight fitting to the frame and sill.

Sec. Appendix K, K103 STRUCTURAL-BORNE SOUND

Section AK103.1. General. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within a structure shall have an Impact Insulation Class (IIC) of no less than 50 (45 if field tested) when tested in accordance with ASTM E 492.